

NUCLEAR DECAY "CONSTANTS" ARE NOT CONSTANT

The common view of radiometric dating is that whatever may be the problems inherent in the method, we are sure at least that the rate of radioactive decay hasn't changed with time. It seems that virtually every discussion of radiometric dating echoes this opinion, as exemplified by the following:

"Early schemes [of geologic dating] did little more than suggest ... that the traditional concept of the 6000-year-old earth did not agree with what could be observed geologically. An adequate means of measuring geologic time was achieved only after the discovery of radioactivity. ... *Scientists found that the rate of decay by radioactivity of certain elements is constant* ... A figure of 4.6 billion years for the earth's total age is now supported by ages based on meteorites and on lead ratios from terrestrial samples" [emphasis added].¹

But what if radiometric decay rates were not constant after all? What if rates of radiometric decay were higher in the past? The implications of these possibilities for the evolutionary chronology are huge, for if decay rates were higher in the past, then a rock or artifact would appear "old" from the amount of radioactive decay it has experienced, but would in fact be "young" since most of the decay had occurred rapidly over a short time.

Significantly, over the years many professional articles have presented evidence that radiometric decay rates have changed over time, and can even be changed today by chemical and environmental factors.

Even mild changes in the environment may affect the stabilities of C-14, Co-60, Cs-137, thus producing markedly different half lives than those predicted for the nuclide decaying in isolation.²

It seems that the idea of atoms decaying independently of each other, or of other nuclides present, is at best only an approximation -- a reasonably good approximation in some cases, but never absolutely true.

Most changes observed in radiometric decay rates are on order of 0.1% to 1%, but some are as high as 20% and more. This knowledge is not new. Decades ago, some two dozen experiments were summarized which reported changes in nuclear decay rates caused by physical or chemical changes in the surroundings.³ More recently, changes in the decay rate of Be-7 due to environmental factors were reported.⁴ An assessment of these results emphasized the challenge they posed to the evolutionary time-scale, lamenting that, "Radioactive decay -- the pacemaker of geologic time -- can no longer be called precisely 'clocklike'."⁵

The mystery is that such conclusions have not become more generally known. **From 1949-1972, easily induced changes in decay rates of 14 nuclides were produced by changes including variations in pressure, temperature, chemical state, electric potential, and stress of monomolecular layers.**

One scientist reviewing these facts concluded, "The equation $N = N_0 e^{-kt}$ can no longer be considered valid. The decay 'constant' has been shown to be a variable, dependent on

the energy content of the entire atom, rather than being dependent only on the mass-energy relationship of the nucleus."⁶

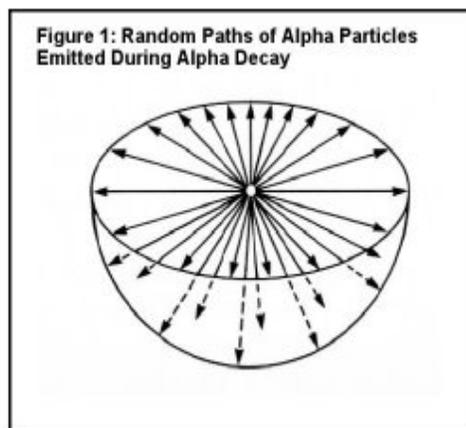
The most obvious answer as to why decay "constants" are assumed constant is the pressure from the radiometric dating community for such an assumption. Nonetheless, the journal *Science* has debunked this assumption, quoting geochemist Douglas Hammond of the University of Southern California: "Everybody always assumes radioactive decay to be totally independent of temperature, pressure, and chemical form. It seems there are some exceptions."⁷

Even changes in the geomagnetic field or cosmic ray exposure appear to affect radiometric decay rates. These possibilities for decay "constant" alteration were observed when the disintegration rate of Cs-133 atomic clocks was shown to vary depending on the direction of circumnavigation in jet aircraft around the earth.⁸

Despite the evidence for variability in decay "constants," the hope is typically held out that evolutionary time is not threatened after all. It has been claimed that, "Creationists hoping to trim geologic history to biblical proportions will be disappointed -- the variations [in nuclide decay rates] seen so far are much too small, just a percent or so, to affect Earth's overall time scale."⁹ This is too hasty a conclusion, however, for changes in decay rates as high as 40% have been induced for certain nuclides.¹⁰ **Changes of this magnitude, if having occurred naturally for many nuclides in the past, would invalidate the entire evolutionary chronology apart from any of the other difficulties with it.**

There is in fact evidence of significant changes in decay rates in the past. Radiohalos are microscopic spheres of discoloration mainly in granites and similar rocks due to the radioactive decay of mineral grains ("inclusions") in the rocks.

The diameter of a halo, diagramed below, is of the order of microns. The dot in the center of the sphere is the radioactive grain causing discoloration. **A constant decay rate would produce a sharply-defined radiohalo of constant diameter for each decaying nuclide as in the diagram.**



However, radiohalos are found with different diameters for the same type of inclusion, and this has been taken by some investigators to imply that decay rates have varied with time.¹¹

Spector concluded that "these halos do not provide proof that the laws of radioactive decay are constant in time."¹² "It is the usual statement in a variety of books, and is generally held to be true, that studies of pleochroic halos have shown that physical processes are indeed invariant over long periods of time," but "a close examination" of theory and of past halo measurements "definitely does *not* support the conclusion that the α decays are constant in time."¹³ The data do "not substantiate the claim of invariance of α decay over periods of 300 to 500 million years."¹⁴

Others have disputed this conclusion,¹⁵ but it is certain that radiohalos do not prove constant nuclear decay rates as some have claimed. Gentry asserted that, even if nuclear decay rates were invariable, "it is actually impossible to establish the constancy of [decay] (for ²³⁸U) from radiohalo data any better than ... 0.35 [35%]. ... In such a case, halos furnish no proof that [decay] is constant."¹⁶

The very existence of radiohalos suggests that decay rates may have been higher in the past. For a uranium halo in the mineral biotite to be darkened requires some 500 million to 1 billion alpha decays.¹⁷ "Therefore, the development of mature U halos in biotites suggests [possibly that] a large amount of radioactive decay has occurred ... [Then] within the Biblical, young-earth creationist timeframe such large quantities of radioactive decay had to occur in a drastically shorter period of elapsed time than the constancy at today's decay rates assumed by uniformitarians would allow. **This in turn would thus imply that there had to have been ... accelerated radioactive decay during earth history ... [bolding added]**"¹⁸

There are other indications that past decay rates were higher than at present. For example, "[Most] radioactive rocks are strongly concentrated toward the earth's surface, particularly in the continental crust. ... [The] flow of heat out of bodies of continental igneous rocks is strongly correlated, at an outcrop-to-outcrop level, with the amount of radioactivity measured in the rocks exposed at the surface. This suggests that the correct surface heat flow is dominated by the radioactive heat generation that has occurred in the recent past in the rocks near the surface. Such a pattern of heat flow is consistent with an episode of accelerated nuclear decay just a few thousand years ago in connection with the Genesis Flood that abruptly raised the temperature in these rocks and caused the subsequent heat flow to be dominated by a near surface contribution."¹⁹

Higher past decay rates mean that radiometric chronologies presuming constant rates are too long, and that a confidence in chronologies based on radiometric dating is ill founded.

Notes

1 Harold L. Levin, *Contemporary Physical Geology*, Saunders, 1986, p. 199.

2 John Lynde Anderson and George W. Spangler, "Radiometric Dating: Is the 'Decay Constant' Constant?," *Pensee*, p. 31.

3 H.-P. Hahn, H.-J. Born and J.I. Kim, "Survey on the Rate Perturbation of Nuclear Decay," *Radiochemica Acta*, Vol. 23, 1976, pp. 23-27.

4 Chih-An Huh, "Dependence of the Decay Rate of ⁷Be on Chemical Forms," *Earth and Planetary Science Letters*, Vol. 171, September 15, 1999, pp. 325-328.

5 Richard A. Kerr, "Tweaking the Clock of Radioactive Decay," *Science*, Vol. 282, October 29, 1999, p. 882.

6 H.C. Dudley, *The Morality of Nuclear Planning*, Kronos, 1972, p. 54.

7 Kerr, op. cit., p. 882.

8 H.C. Dudley, "Phenomenological Causal Model of Nuclear Decay, Assuming Interaction with Neutrino Sea," *Lettre Il Nuovo Cimento*, Vol. 5 no. 3, September 16, 1972, p. 232.

9 Kerr, op. cit., p. 882.

10 Otto Reifenschweiler, "Reduced Radioactivity of Tritium in Small Titanium Particles," *Physics Letters*, Vol. A184, 1994, pp. 149-153.

11 Roy M. Allen, "The Evaluation of Radioactive Evidence on the Age of the Earth," *Journal of the American Scientific Affiliation*, December 1952, p. 18. Allen noted that, "The extent of the haloes around the inclusions varies over a wide range, even with the same nuclear material in the same matrix."

12 R. Spector, "Pleochroic halos and the constancy of nature: a reexamination," *Physical Review A*, Vol. 5, 1972, p. 1323.

13 *ibid.*, p. 1324.

14 *ibid.*, p. 1325.

15 J. Henry, "Polonium Radiohalos: Evidence for Special Creation and a Young Earth," <creation concepts.org>.

16 Robert Gentry, "Radiohalos in a Radiochronological and Cosmological Perspective," *Science*, Vol.184, 1974, p. 66 note 16; Robert Gentry, "Radioactive Halos," *Annual Review of Nuclear Science*, Vol. 23, 1973, p. 353; Robert Gentry, "Radiohalos in a Radiochronological and Cosmological Perspective," *Science*, Vol.184, 1974, p. 66 note 16.

13 Robert Gentry, *Creation's Tiny Mystery*, Earth Science Associates, 1992, pp. 17, 19.

14 Andrew Snelling, "Radiohalos," in L.Vardiman, Andrew A. Snelling, and Eugene F. Chaffin, editors, *Radioisotopes and the Age of the Earth*, Institute for Creation Research/Creation Research Society, 2000, p. 398.

15 Larry Vardiman, "Introduction," in L.Vardiman et al., op. cit., pp. 11-12.